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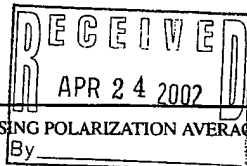


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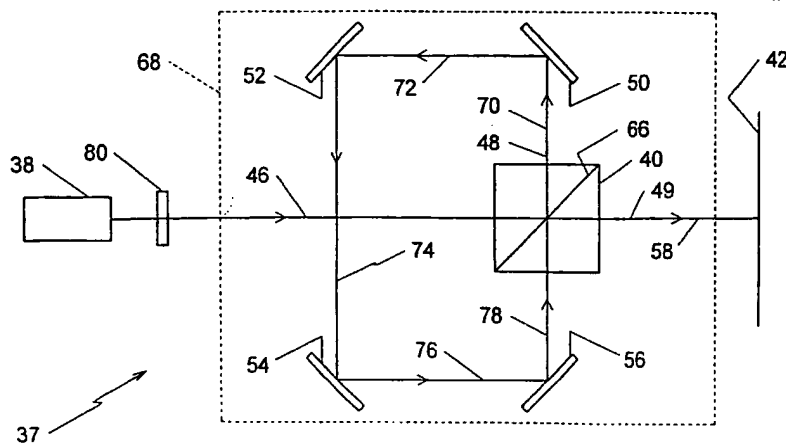
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- (71) Applicant: SILICON LIGHT MACHINES [US/US]; Suite 115, 385 Moffett Park Drive, Sunnyvale, CA 94089 (US). (88) Date of publication of the international search report: 11 April 2002
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- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

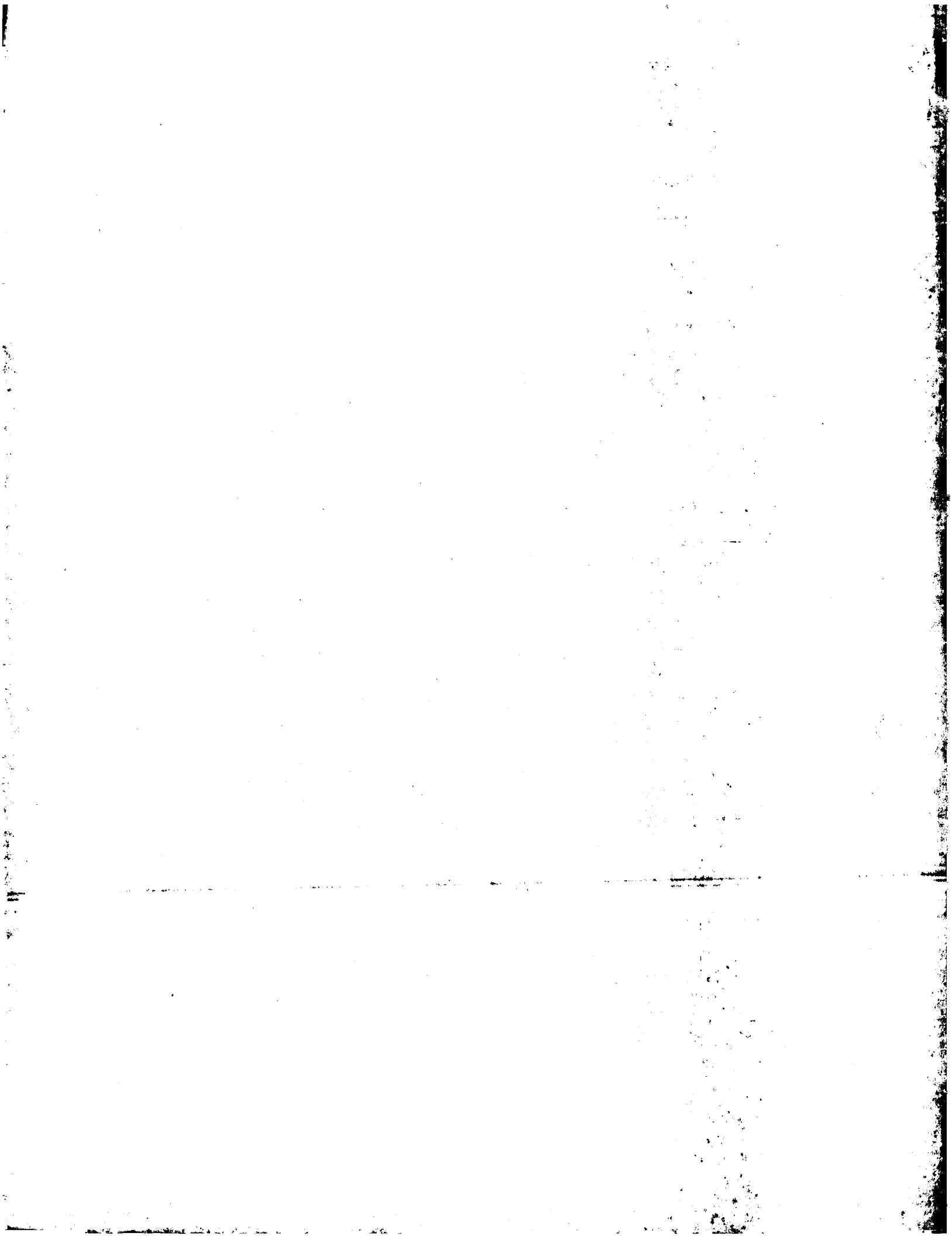


(54) Title: METHOD AND APPARATUS FOR REDUCING LASER SPECKLE USING POLARIZATION AVERAGING



(57) Abstract: A method and apparatus for reducing speckle uses polarization averaging. A polarizing beam splitter divides a first polarized laser output into a second polarized laser output and a third polarized laser output. A plurality of mirrors creates an optical path difference between the second and third polarized laser outputs. The optical path difference is at least about a coherence length for the first polarized laser output. The second and third polarized laser outputs are combined into a fourth laser output, which illuminates a depolarizing screen. If a human eye or an optical system having a intensity detector views the depolarizing screen, the eye or the intensity detector will detect reduced speckle, which results from uncorrelated speckle patterns created by the second polarized laser output and the third polarized laser output.

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# INT. NATIONAL SEARCH REPORT

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PLI/US 01/40049

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G02B27/48

According to International Patent Classification (IPC) or to both national classification and IPC:

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G02B G03H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ, EPO-Internal, INSPEC

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>US 5 463 497 A (IMAI SHUNZO ET AL) 31 October 1995 (1995-10-31)</p> <p>column 14, line 29 - line 67 column 15 - column 17 page 18, line 1 - line 2 figures 9A-9C</p> <p>--- -/--</p>	<p>1,16,19, 34,41, 44,50, 56,59, 62,63</p>

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GOODMAN J W : "Some Fundamental Properties of Speckle" JOURNAL OF THE OPTICAL SOCIETY OF AMERICA, vol. 66, no. 11, November 1976 (1976-11), pages 1145-1150, XP002181682 NEW YORK US page 1147, right-hand column, paragraphs 3,4 page 1148, left-hand column, paragraph 3 ---	1,16,19, 34,41, 44,50, 56,59, 62,63
A	US 4 511 220 A (SCULLY CHARLES N) 16 April 1985 (1985-04-16) abstract; figures ---	1-68
A	US 5 233 460 A (PARTLO WILLIAM N ET AL) 3 August 1993 (1993-08-03) abstract; figures ---	1-68
A	KUNDU P C ET AL: "REDUCTION OF SPECKLE NOISE BY VARYING THE POLARISATION OF ILLUMINATING BEAM" JOURNAL OF OPTICS, vol. 4, no. 3, 1975, pages 63-67, XP002183475 MASSON, PARIS., FR ISSN: 0150-536X the whole document -----	1-68

INTERNATIONAL SEARCH REPORT  
Information on patent family members

International Application No  
PCT/US 01/40049

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5463497	A	31-10-1995	JP 2770984 B2 02-07-1998
			JP 3011614 A 18-01-1991
			JP 2969718 B2 02-11-1999
			JP 3215930 A 20-09-1991
			JP 2765162 B2 11-06-1998
			JP 3252122 A 11-11-1991
			US 5153773 A 06-10-1992
US 4511220	A	16-04-1985	NONE
US 5233460	A	03-08-1993	NONE

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